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FOREIGN BODIES
IN THE VITREOUS HUMOUR.


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presented by the author





Original Articles.

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"I have entered somewhat at length upon this part of the subject, because I feel it to be of great importance to all medical men, and one upon which they should hold strong and decided views."—WELLS.

A case of this character which has, during the past two years, attracted the attention of the medical men of our city; being the indirect cause of two suits for malpractice in our Superior Court against the best known firm of oculists in the Ohio Valley, will form a very good text for our article.

The case is a most typical example of this class of injuries; both as regards the accident, the course, and the termination, when neglected:

"A boy, æt 16, engaged at work in a machine shop, was struck in the left eye by a flying chip of iron. Within an hour and a half he presented himself at the office of the oculists.

Upon examination, the following condition of affairs was found: The lower eyelid, at the junction of the inner and middle third, and at some distance below the margin of the lid, presented an incised wound made evidently by the passage of a quite large foreign body; intense congestion of the eyeball had already set in; corresponding to the wound in the lid was a wound in the sclerotic, at first, owing to the congestion and swelling, made out with difficulty; later, distinctly visible. This wound was far back near the equator, and behind the ciliary body; the anterior chamber contained some blood; the iris was tremulous, from a partial dislocation of the lens; no examination of the interior of the eye with the ophthalmoscope was possible, owing to hemorrhage into the vitreous; vision was reduced to mere perception of light; tension was reduced to —3.

The eye being practically lost; no doubt of the presence of the foreign body within the eyeball to be entertained; and

the danger of future sympathetic trouble in the other eye being always imminent so long as the injured eye remained, the parents were advised to permit its removal. This they decidedly refused to allow.

During a period of over two years following, the patient consulted several other oculists, either at their offices, or at the two free dispensaries conducted by medical colleges of our city. During this period opacity of the lens had early supervened; vision was reduced to weak perception of light; the eyeball retained a diminished tension; the eye was subject to frequent attacks of pain and congestion; was sensitive to pressure; and certainly on several occasions, and probably on many, became the seat of recurrent hemorrhages into the vitreous and anterior chamber.

He then came under the care of still another oculist. The condition above given existed; the anterior chamber was full of blood; vision was *nil*. Under local treatment the blood became absorbed in a few days, until movements of the hand, between the eye and the window could be discerned.

A month later this oculist found a point of tenderness in the ciliary region—downwards and inwards—about 3 to 4 mm. from the sclero-corneal junction. Convinced now of the presence of the foreign body at this point, he made an attempt to extract it, but without success. He now advised them strongly to permit enucleation; but was refused. The patient continued attending irregularly, until sympathetic irritation started up. The Dr. now emphatically advised enucleation, with the proviso, if this was still refused, to have no further connection with the case. The patient gave no decided answer; left; and returned in a few days with probably sympathetic inflammation already under way. The enucleation was now made with at first apparent success in checking the sympathetic trouble. The eye cleared up, vision improved and the outlook was hopeful. Only temporary, however, as the operation had been permitted too late; a plastic irido-choroiditis set up and the eye was hopelessly lost.

The eyeball enucleated was opened,

and the foreign body found beneath the point of tenderness indicated above. It was rather perfectly encapsulated, and on removal was found to be seven thirty-seconds of an inch in length, six thirty-seconds of an inch in width, thin and scale-like, irregularly rectangular in shape, and weighed three-fifths of a grain. The internal structures of the eyeball were greatly disorganized, owing to the long-continued inflammatory condition. The position at which it was found would indicate that it had either shifted its original position during some inflammatory attack, or had rebounded from the opposite wall to the point where afterwards found."

(Extract from a previous report.)

The *diagnosis* in these cases is rarely difficult; usually is perfectly clear and self-apparent, especially when the case can be kept under observation for any length of time. A workman from a factory, a stone-breaker from the roadside, a hunter from the fields, etc., comes with a history of accident; with a perforating wound of the outer tunics of the eyeball; with grave intra-ocular damage; and with diminished ocular tension. There is no very great reason for doubt that the flying foreign body guilty of producing this damage, has entered and lodged within the eyeball.

That a small flying chip or foreign body may have produced this penetrating wound and intra-ocular damage, and then have rebounded is hardly worthy of consideration, so very rarely would this very improbable contingency occur.

That the small foreign body moving with considerable velocity may have passed entirely through the eyeball and into the orbit behind is possible. But while a very greatly diminished intra-ocular tension due to the presence of two outlets for the ocular fluids instead of but one, might lead to a suspicion of this accident, its positive diagnosis would be almost impossible. Even its positive determination would not, in most cases, very materially influence the treatment, when we consider the grave damage that must have resulted, and the fact that a foreign body is still present.

Similar injuries may result from another class of accidents, as those by pointed instruments, thorns, nails, wires, large, hard, angular bodies, etc., where the history of the accident alone will prove that no foreign body is retained, and these injuries

can be at once placed among simple penetrating wounds.

The *course* followed by such foreign bodies may be one of three processes. There may result a relatively slight inflammation leading to the foreign body becoming encapsulated and productive of no further trouble; there may be a relatively severe, acute inflammation at some period, leading to the spontaneous evacuation of the body; or there may be a more or less extended period of attacks of chronic inflammation (possibly with very long intervals of perfect quiet) most likely at some time to lead to sympathetic inflammation and destruction of the second eye.

Cases in which the foreign body has become encapsulated and remained within the eye for many years without giving any further trouble are reported in the literature. However such cases are rare, and the reports are not numerous. Moreover, these cases are not reassuring enough to warrant any hopeful prognosis in the bulk of cases we see.

There is one point that seems to be constantly lost sight of in this connection: the large number of cases reported in the literature where sympathetic trouble has started up after the injured eye had remained quiet for twenty, twenty-five, thirty, or even more years, might just as appropriately have been reported a year or two sooner as cases where the foreign body had become encapsulated and remained innocuous those many years. Too much reliance on these reports of encapsulation is apt to tend to blind us to the danger in the ordinary cases; or even in the cases where this process has seemed to have taken place.

Cases of spontaneous evacuation occur, but these are exceedingly rare. In some attack of acute, usually purulent inflammation, the external tunics may be perforated and the body escape. This probably occurs most frequently with sharp-pointed spicules of glass. In the case of a very large foreign body the eyeball shrinking to an atrophic condition may close down upon it and cause an angle to protrude; so that spontaneous escape may occur, or more frequently an opportunity for ready removal be given.

The vast majority of these cases, however, follow the third course: loss of the eye, repeated attacks of irritation or inflammation, and eventually, if neglected,

sympathetic inflammation and loss of the other eye. So that the two classes of cases form only exceptions which but emphasize this rule. As fair an example of this class as any that could be quoted, is found in the case above recorded.

This brings us then to the main question, that of *treatment*; to which all that we have given above is but an introduction.

On first seeing a fresh case, one where the accident is recent, several plans may be adopted. We may simply employ expectant treatment; we may endeavor to locate the foreign body; we may make an attempt at extraction; or we may enucleate at once.

In favor of an expectant plan of treatment is the fact that in these cases no immediate danger exists. There seems to be no authentic case on record where sympathetic inflammation has set in sooner than two weeks after the accident, and it is rare to see it sooner than four or six weeks. The expectant treatment may merely meet the indications: atropine or eserine, as the position of the wound may indicate; hot or cold applications, as the comfort given will determine (these by all means to be antiseptic); morphia, to relieve pain; and possibly a bandage.

The desire to locate the position of the foreign body is natural. In cases where the media are not cloudy and intra-ocular hemorrhage has not occurred, this may possibly be accomplished by oblique illumination or the ophthalmoscopic mirror. But this class of cases are not the usual ones, and not the group to which we are calling particular attention. Where considerable intra-ocular damage has been done, and the media are hazy or hemorrhage has taken place, we have no assistance from these aids. The body may remain sticking in the wound but not visible; it may have passed into any part of the vitreous; it may be firmly embedded in the opposite wall or even may have passed through, or, as Berlin has called attention, it may have rebounded from the opposite wall to any part of the vitreous chamber. The temptation in such cases to employ an exploring instrument, as a probe, may be very great; the only question that arises is, is this advisable? Bull, in his notes to Wells, remarks in this connection: "Gently probing a wound through the coats of an eye from

which vitreous is protruding, is, under certain circumstances, admissible and even wise (*"Diseases of the Eye,"* 3d Amer. Edit. p. 406). However, he refrains from giving any idea of what these "certain circumstances" are. Zander and Geissler speak of a "vorsichtige Sondirung" (careful probing) in fresh cases; but this is hardly compatible with their later emphatic declaration: "Ein Suchen nach dem fremden Körper durch Probeeinstiche ist durchaus nicht gestattet" ("a search for the foreign body by the introduction of a probe is throughout not allowed."—*"Die Verletzungen des Auges,"* Leipzig, 1864, p. 217.)

Noyes remarks: "Foreign bodies in the eye give rise to most serious complications. If large they may compel immediate extirpation. To detect the presence of a large foreign body supposed to be in the eye, may justify the use of a probe, but this instrument must be handled with the greatest circumspection. There must be a wound quite large, and evidence quite convincing that a large fragment has entered, to authorize one to put in an exploring instrument. It can happen that a fragment has entered through a linear wound behind the equator, not disturbing the iris and lens, and been stopped just inside the globe; a probe would push it farther and destroy the little chance which might have existed of saving the organ. To convince the patient, or one'sself that enucleation is unavoidable, a probe may be used to detect a foreign body in a badly lacerated globe. (*"Diseases of the Eye,"* p. 216, N. Y., 1881). This could hardly be made more disparaging. He would seem only to admit its use, when this would be superfluous; enucleation being an almost foregone conclusion.

Lawson's remarks are hardly as encouraging even as the above. "An attempt to search in the dark for the foreign body will probably only end in not finding it: or if we should succeed in obtaining it, a troublesome inflammation or even supuration may follow, whereas, if the lost eye is removed, all source of irritation is at once disposed of." (*"Injuries of the Eye, Orbit, and Eyelids,"* Phil., 1867, p. 214.)

Whatever view of the pathogeny of sympathetic inflammation we may hold, we find no support given to probing. We may believe sympathetic ophthalmia to be caused by a wound in the ciliary region

implicating the ciliary nerves, (so that even a simple penetrating wound of this region may cause this trouble, as we know clinically); or by the presence of a foreign body, causing irritation of these nerves, which irritation is transmitted along them to the other eye. This belief certainly gives us no warrant for the further introduction, no matter how gently, of an additional foreign body, and the re-opening and re-irritation of the wound.

We may believe the newer Leber-Deutchmann theory of the causation of sympathetic inflammation, by the passage of pathogenic micro-organisms from the originally injured eye to its fellow by way of the lymph channels of the optic nerve sheaths. This view would give us even less warrant for the introduction of an instrument, no matter how aseptic we try to make it, and the re-opening and exposing to external influence, of a wound in a region notoriously difficult to guard.

The question of probing we can then sum up: when the foreign body is visible it is unnecessary; when the body is not visible it is useless or damaging.

We may conclude to make an effort at extraction. In this case it is manifestly better to operate as soon as possible, using the fresh wound of entrance.—But the entire question of extraction we will discuss in all its bearings later on.

The eye may have suffered such severe damage, with extensive wound or lacerations in the ciliary region, that we feel compelled to give an immediate opinion, without any hesitation, that enucleation will be demanded. As we have seen above there is no urgent call for an *immediate* operation. A point in favor of waiting a few days is the practical one that a badly lacerated, collapsed globe is not easy of extirpation; while after a short interval, when the wound has closed and the eyeball regained some sort of tension, the operation is more readily carried out. Another point is that the patient will be in a better condition, physical and mental, to stand the operation; so that, unless something in the individual circumstances of the case demands immediate operation, it is better to carry out expectant treatment for a short time, after which the operation can be made.

So we see that all fresh cases, unless an attempt at extraction is to be made, can be treated expectantly for a short time.

When, then, the surgeon has to do with one of these cases of foreign bodies in the vitreous, he himself should fully realize the gravity of the case, and see to it, also, that the patient and the patient's friends do the same. The entire vocabulary of 'crisp, clean-cut, emphatic Anglo-Saxon' has been exhausted in portraying the dangers attending these injuries, as the following samples will show:

McKeown: "An eye, in which a foreign body is lodged in the vitreous, is doomed, and the patient is fortunate if his other eye escape an attack of sympathetic ophthalmia." (*Dublin Med. Jour.*, 1876, I., p. 201.)

Lawson: "A lost eye with a foreign body within it is a constant source of danger. Generally such an eye shrinks and an unsightly stump remains, but whether it shrinks or not it contains within it an irritant which sooner or later will be a source of much suffering and annoyance to the patient. It will be always liable to attacks of inflammation, which are not only painful but dangerous to the sound eye. In one or other of these attacks of inflammation the sound eye may sympathize, and be either greatly impaired or its vision entirely destroyed by that terrible disease now so well known as sympathetic ophthalmia. As long as a foreign body remains within the stump of a lost eye it is a constant peril to the sound one." (*Injuries of the Eye*, etc., p. 213.)

Wells: "Foreign bodies lodged within the eye are a constant source of sympathetic ophthalmia. Amongst these we must especially enumerate portions of gun cap or of metal, and splinters of glass or stone. They prove a source of constant irritation to the eye, more especially if they are considerable in size, and differ in their chemical constituents from the structures in which they are embedded. Inflammation of the iris and choroid supervenes, and the eye may become gradually atrophied, shrinking down to a small shriveled stump. But even then the danger to the other eye, if that has hitherto escaped, is by no means passed, for such stumps are a source of constant risk as long as they remain painful to the touch and show signs of irritability. Years may elapse after the injury and the patient have long since forgotten his surgeon's admonition as to the danger to the other eye, when suddenly the latter becomes sympathetically inflamed, and, in

spite of all our efforts, perhaps destroyed." (*Diseases of the Eye*, p. 257.)

In a case, then, of this character, we have three alternatives open to us: we may warn the patient as solemnly and emphatically as lies in our power, of the danger under which he constantly rests, urgently insist upon his seeking immediate assistance upon the very first onset of any trouble in the second eye, and leave the case to itself; or we may attempt to extract; or we may unqualifiedly insist upon a preventive enucleation of the injured and lost eye in the interests of the other and sound one.

The first alternative may commend itself to the surgeon who shrinks from the unpleasant duty of interfering with a useless organ, because it *may possibly* never cause such trouble as is dreaded; and again we may be compelled to adopt this course by the patient positively refusing to permit any operative measures of any sort.

Mauthner in this connection remarks: "My rule in such cases is as follows: if the patient is moderately intelligent, has good surroundings at his home, and can at any time summon the counsel of a skillful oculist, preventive enucleation is not necessary. Some ophthalmologists claim that sympathetic inflammation can appear suddenly and without any warning, but such is not my belief. The *intelligent* patient, warned of the threatening danger, and notified to appear at once upon the slightest disturbance on the part of the second eye, will hardly come to us with a pronounced irido-cyclitis, but at the first appearance of the slightest symptom of irritation." (*Sympathetic Diseases of the Eye*, Amer. Trans., p. 163, New York, 1881.)

He thus bases his practice upon the assumption that in all these cases the advent of sympathetic inflammation is preceded by a period of well marked sympathetic "irritation;" and that during this period enucleation is entirely capable of checking the further progress of the malady. But Wells is not so sanguine: "For we have no guarantee that we shall have time to check the sympathetic inflammation if it has once broken out, even by a speedy removal of the injured eye. For although symptoms of sympathetic irritation not infrequently usher in the inflammation, and the latter may be prevented by the excision of the injured eye at this premonitory stage, yet this is not always the case. The inflamma-

tion may occur without any premonitory symptoms, and advance so rapidly that in a few days the integrity of the eye may be greatly, and perhaps permanently, impaired. Such a case should warn us of the danger of procrastination in excision of the blind, injured eye, in the hope that there will always be time enough for this when symptoms of sympathetic irritation manifest themselves, or during the earliest stage of sympathetic inflammation. For the former may never occur, and the latter may be so rapid in its development and course that great and irremediable mischief may be done before we can enucleate the other eye" (*"Diseases of the Eye,"* p. 262).

There are other points to be taken into consideration in deciding whether it be best to leave the case to itself. Carter speaks of the fact that an intelligent and cultured patient, within reach of surgical skill, may be trusted to watch his own case; but adds: "In this class, however, the influence of expectant attention may be itself injurious; and a person who is always on the watch for changes in the uninjured eye will be liable either to produce them, or to imagine them before they occur." (*"Diseases of the Eye,"* Philadelphia, 1876, p. 410). We can readily conceive than an intelligent, sensitive man, especially if a bit introspective, who had been properly warned, and who kept constantly before his mind's eye a picture of this uncertain, indefinable, but ever-present danger hovering over him, (and if he does not do this our solemn warning is as well as wasted) could pass many uncomfortable, unpleasant hours.

Wells very properly calls attention to another consideration: "Moreover, there is another point which weighs heavily in the scale amongst persons whose livelihood depends upon their work, and that is the long time which is lost by them during the treatment of the injured eye. For it may remain painful and irritable for many months, and thus render the patient quite unfit to use the sound eye." (*"Diseases of the Eye,"* p. 262.)

As regards an ignorant patient, Mauthner disposes of this question with his characteristic force: "If, on the other hand, we have before us one of the lower classes, a patient defective in intelligence, and in whom carelessness and mistrust of medical assistance are narrowly united;

one whose remaining eye is liable to be overburdened with severe labor, and who cannot, even with the best intentions, get the advice of an oculist; then we may employ all our eloquence in favor of a preventive enucleation. For, notwithstanding our most earnest warnings, as well as all our representations that the patient will be totally blind for life if he neglects to report at the proper moment—despite all sorts of promises on the part of the patient that he will seek advice when the slightest irritation appears, we may never see such a patient again until vision shall have been irrevocably destroyed by a genuine attack of irido-cyclitis. Of what avail, then, to overwhelm the unfortunate patient with reproaches, to remind him of his promises, and even to fly into a passion, or to melt into pity, when he mildly says that he thought the eye would get well of itself, or that he sought help at the hands of some old woman!" (*"Sympathetic Diseases of the Eye,"* p. 164).

So that leaving one of these cases to time and good fortune, no matter how well warned, should not be undertaken without some very decided misgivings.

There remains then to discuss the questions of extraction or extirpation; and the pros and cons of these two operative measures.

With the presence of a foreign body anywhere, there arises the general surgical rule to attempt its removal. We might also assume this, *a priori*, with foreign bodies in the vitreous; but we will soon find important factors modifying our rule. In speaking of these cases, Haynes Walton remarks: "The desideratum is to extract the object, just as when any other part of the eye is invaded, but the means of execution are only just within the range of possibility. The principle of treatment here is, therefore, reversed; the rule being to do nothing in the way of extraction, the exception being to extract. To warrant any interference, the body must be visible, and advantageously placed for removal." (*"Diseases of the Eye,"* 3rd Ed., London, 1875, p. 506). We can then divide these cases into two groups: one including these exceptional cases where the body can be seen, or located; and the other, including the ordinary cases where the body is invisible and cannot be located with any degree of certainty.

The first group will include those cases

in which the foreign body is visible in the vitreous, either by oblique illumination or by the light from the ophthalmoscopic or forehead mirror, the media not being obscured by infiltration or blood, and the body itself being seen, or the coagula in which it rests; it includes the cases where the sclera being thinned and discolored at some point, especially if this be painful to the touch and injected, indicates the site of the foreign body; or the cases with no external signs, but with a point persistently painful and sensitive to the touch of a probe, indicating the probable site of the body; it also includes those cases with hazy media, preventing the inspection of the interior of the eye, but with some vision remaining, and showing a large and distinct scotoma in some part of the field, corresponding to the very probable position of the foreign body.

In this class of cases an attempt at extraction is permissible, and may possibly be successful.

The other group includes the bulk of the cases; where severe intra-ocular damage has been done; the media are hazy or hemorrhage has taken place; traumatic cataract has supervened, or the pupil has become occluded. In all these cases no attempt at extraction is at all warranted.

The technique of extraction we may dispose of very shortly. In the cases where a discolored, or a sensitive or injected spot in the sclera indicates the site of the foreign body, this may be very carefully cut down upon; and if the foreign body is thereby revealed, it may be removed by delicate forceps. In those cases where the body is revealed by the ophthalmoscope, or by a sector lacking in the field of vision, its position should be determined as accurately as possible, and an incision (corresponding to this determined position when practicable) made through the sclera; then a delicate forceps, a small bent hook, or Knapp's delicate curette, may be passed down to the pre-determined site of the body, and an attempt made to seize it or draw it out.

In this manner, in these rare cases, the skilful operator may, now and then, be happily successful; but the instances will be few indeed. Hirschberg states that during his first ten years of practice he was not enabled by simple mechanical means to extract the foreign body in any single instance, and still retain any vision (*"Der*

Electro-Magnet in der Augenheilkunde," Leipzig, 1885, p. 41). Yet that his opportunities were ample, is shown by a dissertation of one of his scholars covering a little more than this period, which records, among in-patients, 520 injuries of the eye (Hornburg: "*Beitrag zur Casuistik und Statistik der Augenverletzungen*," Berlin, 1883).

To read the cases reported at length in the text-books, one would suppose that such an operative triumph, as removing a foreign body from the vitreous, was neither rare nor remarkable. One case especially (Dixon's) has done time-honored and veteran service. Yet Knapp, in the most complete and carefully worked out article (*Archives of Ophthalmology*," etc., vii. 1878, p. 330) could only find 16 cases in the literature of successful extraction, and only four of these with moderately good vision remaining. Although this figure is nothing like the number of extractions that have really been made; yet this paucity of reports gives a fair comparative idea of the rarity of this operation, with anything like a good result.

Undoubtedly the failures have been vastly more numerous; and in view of this very probable contingency, the surgeon should fortify himself beforehand with the proviso mentioned by Lawson: "In all cases where the surgeon deems it right to attempt the removal of a foreign body from within the eye, he ought to have a discretionary power, that if he fail to find it, he may remove the globe whilst the patient is still under chloroform, if circumstances render it advisable." (*Injuries of the Eye*," etc., p. 220).

There is another point at least worth mentioning, although it is of such extreme rarity that it can bear little weight; but as it tends in the direction we are moving, it can be given for what it is worth. It is a point mentioned by Carter: "When a foreign body is lodged within the eye, it may sometimes be within reach of removal, and its removal may leave possibilities of recovery. The question then will be whether it is necessarily the only one that has found entrance; and in a case in which many particles have been flying about it will not be safe to assume the correctness of an affirmative reply without good reason." (*Diseases of the Eye*," p. 410). He then reports a case in which after enucleation two shot were found in the eye. Dr. E. Williams reports a case in which, with

but one external wound, three shot were found in the eye. Dr. Jos. Aub reports a unique case in which two bits of iron were extracted (eleven days apart) from an eye by the use of an electro-magnet. Such cases, supposing that but *one* of these foreign bodies had been extracted, would be in a very dangerous state of false security.

Without laying any more stress upon the rarity of the successful termination of these attempts at extraction; and without discussing the difficulty of the operation, for of all ophthalmic operations this probably requires the most consummate operative skill and dexterity; we may presume that a successful extraction has been accomplished. The question then arises, have we reached the solid ground of perfect safety? We have remaining an eyeball with a penetrating wound of its outer coats, probably involving the ciliary region; with the internal structures badly disorganized; probably with irido-cyclitis or choroiditis; and possibly with the lens injured. What are our teachings in regard to such an eye, independently of the existence of any foreign body within it. All our teachings, all our text-books, emphasize the fact that such an eye is liable to give rise to constant trouble, and jeopardize the safety of the other and sound eye.

Carter states: "The conditions which almost certainly produce sympathetic ophthalmia are wounds or rents which implicate the ciliary region; and the lodgment of foreign bodies within the eyeball. Those which often produce it are wounds or rents which render the ciliary nerves adherent in the resulting cicatrices; which are followed by chronic inflammation or obstinate neuralgia or which ultimately lead to the ossification of exudations in the choroid. I advise enucleation without delay when an eyeball is broken up and disorganized by a blow, or by a puncture from a coarse instrument; when the ciliary region is either ruptured or cut through; when any foreign body is lodged within the eye; when, at any period after an accident, there is abiding tenderness of any part of the ciliary region, with liability to conjunctival flushing when the eye is lightly touched for the purpose of examination; or when there is any sense of bony hardness conveyed by palpation of the deeper parts of the injured globe. In some of these conditions sight would necessarily be extinct, in others it might be remaining in

some degree; but on the grounds already stated, this would have little bearing on the course to be pursued. A seriously damaged eye can never be worth saving at the cost of actual risk to its fellow." (*"Diseases of the Eye,"* p. 410). This will sufficiently show that other conditions besides the foreign body, *per se*, are elements of danger; and that consequently it follows that the removal of the foreign body does not necessarily mean the removal of every element of danger.

If one examines a series of cases of sympathetic ophthalmia, he will see that foreign bodies are not the preponderating cause. For example, in the first series I have at hand, Vignaux's (*"De l'ophthalmie sympathique,"* Paris, 1878), among 90 cases but six are charged to foreign bodies; the balance to wounds, contusions, irido-cyclitis, phthisis bulbi, staphyloma, and a variety of other causes. Of striking interest in this connection is the fact noted that in one of these six cases the sympathetic ophthalmia occurred ten months after the foreign body had been extracted. (Case LIV. p. 125).

We have but meagre records to show the future course of these cases of extraction. The most valuable series I know is that given by Aub: "From 1875 to 1881 I had eight different times attempted the removal of pieces of gun-cap, iron or steel from the vitreous by aid of forceps. Twice the ordinary horse-shoe magnet was called in to assist in the operation. Six of the eight cases were relieved of the foreign body; but in two I utterly failed. In all cases the operation was followed by severe inflammation, and enucleation of the eyeball had to be performed sooner or later, either by myself or some other oculist." (*"Trans. Amer. Ophthalmological Soc."* 1884, p. 739).

Thus we fail to find any warrant for a feeling of perfect security on the part of the surgeon after he has succeeded in making an extraction; while we can understand the delusive sense of security felt by the patient. We saw above how often it happens in these cases of foreign bodies, that, notwithstanding all our warning and advice, these patients return only when the sympathetic trouble had so far progressed that the day of grace is past. How much stronger would be the tendency for the patient to neglect matters, after he knows that the foreign body has been removed; even probably retains it in his possession

as a memento, religiously regarding it as a pledge of the past for the safety of the future. In one sense, it is probably fortunate that so many of these attempts at extraction are failures, and enucleation follows at once.

Under the older view, that sympathetic ophthalmia was caused by irritation transmitted by the ciliary nerves, it is at once apparent that the removal of a foreign body would not be sufficient to remove the danger of this trouble, when there was left behind all the conditions for maintaining irritation of the ciliary nerves. Under the newer views of Leber-Deutschmann, which the experiments of Deutschmann particularly have rendered very probable, that sympathetic ophthalmia is caused by pathogenic micro-organisms being carried into the interior of the eyeball by the foreign body, and after proliferating, being carried to the other eye by the lymph canals of the optic nerve; the removal only of the foreign body would be futile, when we bear in mind that the real causative agents would, almost necessarily, be left behind.

The only perfectly safe rule in these cases is to enucleate the injured and lost eye; and thus secure the safety of the other sound one.

These are the perfectly legitimate conclusions to which the great majority of oculists have long since come; especially the oculists of England, that great industrial nation, where the experience with this class of injuries has been vast. These conclusions still hold good for the foreign bodies of glass and stone, wood, lead and copper, etc.; but of late years the bits of iron and steel have been placed in an entirely different group, by the employment of the electro-magnet for their removal.

The experience of the past decade with the electro-magnet in this field has been extensive. Hirshberg in his recent monograph (*"Der Electromagnet in der Augenheilkunde,"* Leipzig, 1885) records the known cases, 171 in number (a large proportion in the vitreous). There can be no question but that the introduction of the electro-magnet for this purpose has been a most brilliant advance in ophthalmic surgery. In certain cases (and unfortunately this class is not large) it can render inestimable service; but the tendency is to apply it to all sorts of cases without any regard to their character; the only consid-

eration apparently being to get the offending object out.

One receives the impression from reading the literature that the authors were convinced that there is some difference, in essence, between an extraction by mechanical means, as forceps, hook, etc., and an extraction by means of the magnetized probe. The essential difference between a pair of forceps entering and *grasping* the body; and a tip of the magnet entering and *attracting* the body is simply nothing. The question of mechanical disturbance is entirely secondary, and may be greater under either plan, as circumstances may determine. The magnet, as a rule, would unquestionably have the advantage in this respect.

In point of ease and certainty the magnet is vastly superior; and this has lessened the number of failures and very greatly increased the number of successful cases. But granting this to the full, we can not see how the gloomy views as to the future of these cases, given at length above, do not apply with as equal force to the cases in which the extraction was accomplished by the magnet, as to those cases in which the extraction was effected by simple mechanical means. Knapp gives voice to these same misgivings in the discussion to Dr. Aub's paper, quoted above,—“In regard to foreign bodies in the vitreous chamber, it is a very nice thing to attempt their removal, and occasionally we succeed; but from my own experience and from a study of the literature, I have sometimes thought that it would be best to take all such eyes out without any scruple. I am sure that by proceeding in this way, the greatest good would be done to the greatest number. More eyes containing foreign bodies are destroyed by surgical interference and temporising treatment than would be if we took them all out at once. One case of sympathetic ophthalmia weighs heavier, is a greater misfortune to humanity, than ten cases in which one eye was removed, but the other preserved intact. It is a very gratifying clinical performance to extract, with a magnet, a piece of steel from the depth of the vitreous chamber; the students wonder and applaud, but only a few cases are benefited for a length of time. The development of a good deal of cicatricial tissue, cyclitis, etc., are apt to follow in the wake of the brilliant operation, and nobody can

tell whether and how long the fellow eye will remain unaffected.” (“*Trans. Amer. Ophth. Soc.*,” 1884, p. 747).

If we study Hirschberg's cases we obtain very similar impressions. He had employed the electro-magnet in twenty-three cases of bits of iron or steel in the vitreous or fundus. In thirteen cases the attempts was unsuccessful; while in ten cases he succeeded in removing the foreign body. *But what is of most striking interest is the fact that in four of these ten cases he was obliged later on to enucleate the globe.*

So we see that clinically all these cases had better be grouped together; and it seems safest to fall back upon the emphatic, unqualified dictum of Lawson: “There is but one line of treatment to be adopted in such cases, and that is to remove the stump or what remains of the lost eye.” (“*Injuries of the Eye*,” p. 214).

The objections to enucleation have been upon the ground of its danger; or upon cosmetic grounds. There have, to be sure, been a few deaths following enucleation. The best recent article, a lecture by Dr. Brückner, edited by Prof. Deutschmann (Græfe's “*Archiv für Ophthalmologie*,” 31, iv., 1885, p. 251), tabulates the cases in the literature. This embraces twenty-two fatal cases, and although at first glance I miss Mauthner's and Vignaux's cases, and probably others are lacking, still the total is probably not over thirty. Since that paper was written, at this year's meeting of the Société Française d'Ophthalmologie, Dor reports two fatal cases, Gayet reports four, and Galezowski two. As for obvious reasons many cases would remain unreported, the total begins to assume a disheartening magnitude. The cases have died from a purulent meningitis, caused as Deutschmann thinks by an infection of the exposed orbital tissues. In the recent cases of Benson and Leber the micrococci were found in the optic nerve sheath, chiasm, sixth nerve, cavernous sinus, etc. Gayet, in the above discussion, was of the opinion that careful antiseptic precautions would render the operation entirely void of danger.

The cosmetic objections are several. Whether a shrunken, unsightly globe is preferable to the closed, sunken lids is a matter of individual taste; and if no other considerations were involved might be a question worth discussing. Another objection, coming particularly from the

French, the sticklers for appearance, is that after enucleation there remains a poor basis for an artificial eye; an atrophic stump giving a more movable basis, and producing a more deceptive appearance. Lawson disposes almost contemptuously of this objection: "My own feeling is, that when, after a careful examination, it has been accurately decided that the eye is lost, it is far the safest and wisest plan to remove it; a long period of certain anxiety is saved, for a man must be anxious who has lost one eye, and knows that the other is, as it were, in the balance; all further suffering is thus put an end to, and the safety of the other eye is insured.

Surely these three considerations must weigh well with a sensible man against the simple fact that the stump of a lost eye is a good button upon which to hang an artificial one; for though the deception in such cases is more complete than when the globe has been excised, it is in truth nothing more than balancing the worth of the seemingly appearance of an artificial eye against the chance of losing a sound and living eye." (*"Injuries of the Eye,"* p. 256).

The objection that in children the corresponding orbit and side of the face will not grow symmetrically, and a glass eye is dangerous, can be obviated somewhat by using a celluloid, unbreakable eye.

The substitutes that have been proposed for enucleation of the globe are neurotomy, with preservation of the globe; and exenteration, with preservation of the sclera.

The operation of neurotomy has appeared under several guises. There has been proposed an intra-ocular partial neurotomy of the ciliary nerves in cases of a *localized* tenderness of the ciliary region, by making an equatorial incision through the sclera back of the tender spot, and thereby cutting through the nerves passing from it. It has been proposed to cut the optic nerve and preserve the ciliary; and it has been proposed to cut the ciliary and preserve the integrity of the optic. Finally it has been proposed to cut both, the ordinary optico-ciliary neurotomy; and it has even been proposed to improve on this by making it a neurectomy.

To say nothing of the difficulty of these operations; it has been shown by clinical experience that they are not sufficient in all cases, to do away with the danger of sympathetic ophthalmia; and they have been very generally abandoned.

The operation of exenteration, or removal of all the contents of the globe, deserves more attention. It is of some interest to study the historic development of this operation. Its true progenitor was the old operation of Barton, which consisted in making a free incision in the front of the eye, applying a poultice, and trusting that, with the contents of the eyeball, the foreign body would be found on the poultice next day. This was soon abandoned on account of the severe panophthalmitis set up, the tedious and painful recovery, and the fact that the stump left was often irritable and not a perfect safeguard against sympathetic trouble. The next step was the operation of abscission or cutting off the front of the eyeball, and allowing contents and foreign body to escape. This was also abandoned as forming no perfect safeguard against the future occurrence of sympathetic ophthalmia.

The perfected operation, exenteration, consists in cutting off the front of the eye, just back of the sclero-corneal junction, scraping out the contents with an aseptic spoon, washing out the cavity very thoroughly with antiseptic solutions, and drawing the sclera together by a "tobacco-pouch" suture.

So far as our experience goes this operation has decided advantages. It is at least as easy, perhaps easier, to perform as enucleation. It seems to be a perfect safeguard against sympathetic trouble; although more time will be required to demonstrate this with perfect certainty. It has the very great advantage of securing an excellent stump for an artificial eye; with amply wide movement. It has so far been free from any fatal results. One uncomfortable case is recorded by Knapp. This patient after evisceration developed a severe orbital cellulitis with obscure cerebral symptoms. The patient recovered and the result was excellent, yet as Knapp says, "it had not been attained without danger to life." Knapp explains the case by the fact that the rigid sclera holds the venæ vorticosæ open and gaping, a favorable condition for thrombosis; which if any infectious material is present may assume a malignant character. This case led Knapp to the following conclusions: "I cannot consider evisceration to be a harmless operation until extensive statistics have converted me to the contrary opinion. Alfred Græfe and the host that have copi-

ed him say that evisceration is less dangerous than enucleation because 'it does not wound the ways of communication between orbit and cranium, especially the lymph-sheath of the optic nerve, through which the traumatic inflammation is propagated.' Every explanation, as well as every operation, has to stand the test of time, and the future has to show whether evisceration is devoid of danger. All oculists that have practiced evisceration to some extent state that, in general, the reaction is more severe and the time of recovery longer than after enucleation. Where there is moderate reaction in many cases, and great reaction in some, as in the one above reported, I think we should be on our guard, lest in some case or other the operation prove fatal." (*"Archives of Ophthalmology,"* 1885, p. 311).

When it has been proven safer; its equal ease of performance; its equal protection against sympathetic trouble, and its superiority for carrying an artificial eye, will cause evisceration to replace enucleation. Until then we can keep on with the older, well tested operation.

We can then sum up with the following conclusions:

An eye with a foreign body in the vitreous is almost invariably lost, as far as regards vision.

Such an eye will remain subject to attacks of inflammation; and is almost certain at some time or other to produce sympathetic ophthalmia.

When the body can be located an attempt at extraction may possibly be successful.

When the body cannot be located, no attempt at extraction is at all permissible.

Even after extraction, neither the safety of the injured eye, nor of the sound eye is completely assured.

This is equally true of magnet extractions.

No substitute for enucleation will assure this, unless possibly evisceration will prove to do so, subject to the test of experience.

The danger of enucleation can be reduced to the minimum by the strictest antiseptic precautions.

It follows then that the ONLY PERFECTLY SAFE AND CERTAIN TREATMENT IN THESE CASES IS THE PREVENTIVE ENUCLEATION OF THE INJURED AND LOST EYE, IN THE INTEREST OF THE OTHER AND SOUND ONE.

